

1

AD 43827
FOREIGN TECHNOLOGY DIVISION



PROCESS FOR IMPROVING THE RESISTANCE OF
POLYCHLOROPRENE RUBBERS IN THE PRESENCE
OF AGGRESSIVE MEDIA, ESPECIALLY FREEZING
AGENTS AND OILS

by

Adolf Heger and Günther Carius

DDC
DEFENSE
RESEARCH
AND
TEST
DIVISION
1972



Approved for public release;

distribution unlimited.

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. Department of Commerce
Springfield VA 22151

EDITED TRANSLATION

PROCESS FOR IMPROVING THE RESISTANCE OF
POLYCHLOROPRENE RUBBERS IN THE PRESENCE OF
OF AGGRESSIVE MEDIA, ESPECIALLY FREEZING
AGENTS AND OILS

By: Adolf Heger and Günther Carius

English pages: 4

Source: German Patent No. 69924
(WP 39 b/31 702),
April 24, 1968, 1969, 2 pages.

Translated by: Ernest A. Novak/NITH

Approved for public release.
distribution unlimited.

GE/0000/69/000/000

THIS TRANSLATION IS A REBODIMENT OF THE ORIGINAL
MATERIAL TEST WITHOUT ANY ANALYTICAL OR
SINTERIAL COMMENT. STATEMENTS OR THEORIES
ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE
AND DO NOT NECESSARILY REFLECT THE POSITION
OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION
WPAFB, OHIO.

PREPARED BY:
TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WPAFB, OHIO

FD-171-23-680-71

Date 31 Aug. 19 71

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D	
(Security classification of this document may be different from the overall report classification)	
1. INFORMATION SECURITY CLASSIFICATION	
2. SECURITY GROUPING	
3. PROJECT NO. 7343	
4. CONTRACTING ORGANIZATION	
5. CONTRACTING ORGANIZATION ADDRESS	
6. DISTRIBUTION STATEMENT	
Approved for public release; distribution unlimited.	
7. SECURITY NOTES	
8. SPONSORING ORIGINATING ACTIVITY	
Foreign Technology Division Wright-Patterson AFB, Ohio	

The purpose of this invention is to develop a process that enables the polychloroprene rubbers to resist corrosive materials especially refrigerants and oils, to be so improved that the polychloroprene rubbers, preferably in the form of sealing elements, can be used for moving parts, and to increase the degree of cross-linking without increasing the cross-linking agent too much. In accordance with the invention the task was solved by the fact that chloroprene rubber articles which are cross-linked chemically with standard cross-linking agents in the well-known manner were exposed to energy radiation, for example, electron rays or gamma rays in which the dosage amounted to a given radiation. The energy of the energy-rich radiation must be matched to the geometric dimensions of the body to be radiated in such a way that somewhat homogeneous dosage distribution is attained over the body to be radiated. If necessary, in order to attain homogeneous dosage distribution a multistaged radiation can be used.

UNCLASSIFIED
Security Classification

KEY WORDS					
LINE A	LINE B	LINE C			
SEC	WT	SEC	WT	SEC	WT
Polychloroprene					
Polymer Cross-Linking					
Radiation Effect					
Frccon					
Elongation					
Impact Strength					
Electron Radiation					
Chemical Patent					

UNCLASSIFIED
Security ClassificationUNCLASSIFIED
Security ClassificationDD FORM 1473
NOV 1968

Furthermore, by attaining a comparatively high degree of cross-linking and a corresponding thinning of elastic phase, the swelling, caused, for example, by Freon-22 refrigeration machine oil mixtures, is considerably reduced so that at least a reliable seal is guaranteed in connection with dead load cases.

Increasing the degree of cross-linking by increasing the concentrations of the cross-linking agent is, however, limited because an excessive amount of the cross-linking agent leads to faster aging and consequently hardening. In the final analysis elastomers are also only slightly resistant to refrigerant oil mixtures. [Translators note: The following two sentences are incomplete.] Nitrile rubber mixtures are, of course, oil resistant but nevertheless the resistance of the refrigerant for the most part is not sufficient. Polysulfides have a good refrigerant and also oil resistance but the elastic characteristics are unsatisfactory. Even highly fluoridated elastomers which are characterized by a good temperature and solvent resistance, for the most part are not satisfactory with regard to their permanent deformation in refrigerant oil mixtures.

It is also well-known that the characteristics of any elastomers change due to the influence of ionized radiation.

The purpose of this invention is to develop a process that enables the polychloroprene rubbers to resist corrosive materials especially refrigerants and oils, to be so improved that the polychloroprene rubbers, preferably in the form of sealing elements, can be used for moving parts.

The purpose of the invention is to increase the degree of cross-linking without increasing the cross-linking agent too much. In accordance with the invention the task was solved by the fact that chloroprene rubber articles which are cross-linked chemically with standard cross-linking agents in the well-known

PROCESS FOR IMPROVING THE RESISTANCE OF POLYCHLOROPRENE RUBBERS IN THE PRESENCE OF AGGRESSIVE MEDIA, ESPECIALLY FREEZING AGENTS AND OILS

Adolf Heeger and Günther Carius

The invention concerns a method of improving the resistance of polychloroprene rubbers in the presence of aggressive media, especially freezing agents and oils, advantageously when the polychloroprene rubber is used in the form of a sealing element for seals.

As is well-known, polychloroprene rubber is chemically cross-linked by adding cross-linking agents, e.g., mercaptodimidazole. When used in refrigeration engineering to seal against refrigeration agents and oil mixtures, i.e., a rubber is attack not only by the freezing agent such as halogenated hydrocarbons in the process of extraction and sealing but it is also greatly effected by the refrigeration machine oil as a result of the swelling. This then softens the polychloroprene rubber and its service life is greatly reduced. In the past, this fact has been countered when the refrigeration machine oil which is always found in the refrigeration cycle, is added to the polychloroprene rubber as a softener and in so doing the swelling equilibrium is quickly attained. Refrigeration machine oil as a softener, however, leads to an extraordinary retardation of the vulcanization process and the typical optimal characteristics of polychloroprene rubber are not attained.

manner were exposed to energy radiation, for example, electron rays or gamma rays in which the dosage amounted to 2.10^7 to 4.10^7 rad. The energy of the energy-rich radiation must be matched to the geometric dimensions of the body to be radiated in such a way that a somewhat homogenous dosage distribution is attained over the body to be radiated. If necessary, in order to attain homogenous dosage distribution a multi-sided radiation can be used.

In accordance to the invention sealing elements that are made of polychloroprene rubbers can be used in connection with refrigerant-oil mixtures in connection with which a real improvement in the service life is attained.

The invention is to be explained in greater detail in the following by means of a slighted example. Sealing rings with a cross-sectional diameter of 5 mm that are made of chemically chain-linked polychloroprene rubbers were subjected to radiation from two sides with electrons of 1 MeV energy level in which the dosage was $3.5 \cdot 10^7$ rad.

In the following table the characteristics of the radiation chemical recross-linked specimens of polychloroprene rubber are compared with the characteristics of the specimens that were only chemically cross-linked but of the same material prior and following swelling for 168 hour in a freon refrigeration oil mixture at 70°C .

Characteristics of the rubber	Cross linked	Radiation
before swelling	before swelling	before swelling
after swelling	after swelling	after swelling
before swelling	before swelling	before swelling
before swelling	before swelling	before swelling
Elongation at break (%)	94	73
Impact elasticity (%)	20	50
Shore A hardness	86	70
Mass change (%)	-	32.70
Length change (%)	-	10.60
Volume change (%)	-	36.70

Patent Claim:

1. Process for improving the resistance of polychloroprene rubbers against corrosive materials, especially refrigerant oils characterized by the fact that chloroprene articles which were chemically chain linked in the well-known manner with standard chain linking agents are subjected to radiation rich rays in which the dosage amounted to 2.10^7 to 4.10^7 rad.

2. Process in accordance to claim No. 1 that is characterized by the fact that electron beams were used as the radiation source.

3. Process in accordance with claim No. 1 characterized by the fact that gamma rays were used as the radiation source.

4. Process in accordance with claim No. 1 to 3 characterized by the fact that in order to attain a homogenous dosage distribution rays were used from several sides.